

REMARKS/ARGUMENTS

Reconsideration of the subject application in light of the following remarks and arguments is respectfully requested.

The claims pending in the subject application are directed to a voice coil actuator in which first and second magnets and a first soft magnetic pole piece are positioned along a common axis. A coil having a length less than the first soft magnetic pole piece is positioned to travel along the common axis. Also included is a structure that provides a magnetic path between the free ends of the magnets with respect to the first soft magnetic pole piece.

Such a structure, through the dimensioning of the first and second magnets, the first soft magnetic pole piece, and the ampere-turns through the coil, can provide a desired force versus stroke characteristic, such as one which can be viewed as having an "electromagnetic spring" constant.

Objection to the Drawings

On page 2 of the Official Action, the Examiner objected to the drawings under 37 CFR 1.83(a) "because they fail to show 'two different size magnets in structure connecting free ends of the magnets' as described in the specification."

Applicant respectfully requests clarification of this objection. Applicant is unable to locate in the specification the phrase "two different size magnets in structure connecting free ends of the magnets" quoted by the Examiner as coming from the specification. A citation to the page and line number of the specification would be helpful to the Applicant so that the context and meaning of the passage can be understood and the Examiner's objection properly addressed.

To the extent the Examiner is questioning whether an embodiment of the claimed invention is shown in which magnets of two different sizes are employed, the Examiner's attention is directed to Fig. 5 in which permanent magnet 44 has a different size from that of permanent magnet 42. To the extent the Examiner is

questioning whether the drawings show a structure which provides a magnetic path between free ends of the first and second magnets, the Examiner's attention is directed to Fig. 5 outer shell 52 which is an example of a structure which provides a magnetic path between free ends of the first and second magnets.

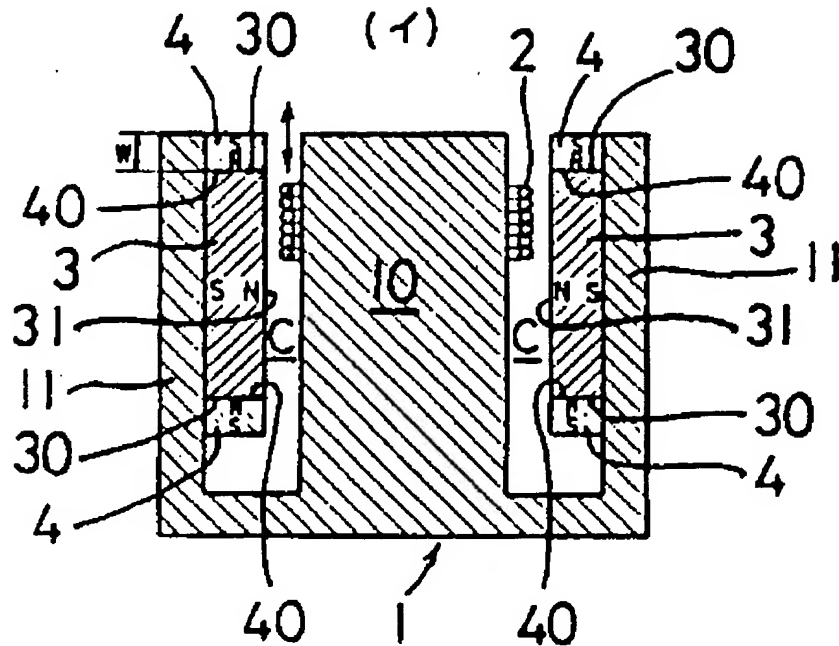
Amendment to the Drawings

The proposed amendment to Fig. 3 is to correct the lead line for "outer shell 22" so that it points to the outermost pair of parallel lines, instead of the structure designated as "pole piece 28." This change is consistent with the designations used to indicate the outer shell in the other depictions of voice coil actuators shown in Figs. 1 and 5. Also included is an attachment which indicates in red the proposed changes to the lead line for "outer shell 22" in Fig. 3. Approval of the proposed amendment to Fig. 3 is respectfully requested.

Claim Rejections

The Examiner has relied upon JP 62-173968 (inventor: Shinichi Hayashi et al.) to reject claims 1-3, and 5-6 under 35 U.S.C. 102(b), and claim 4 under 35 U.S.C. 103(a). Applicant respectfully traverses this rejection.

According to the Document Bibliography and Abstract for JP 62-173968 provided with the official action, the disclosed Voice Coil Motor employs an "operating permanent magnet 3" and "auxiliary permanent magnet 4" arranged on one or both end surfaces 30 of the permanent magnet 3. An enlargement of Figure 2 from JP 62-173968 is reproduced below:



It is respectfully submitted that the structure in JP 62-173986 being relied upon by the Examiner is an all-permanent magnet structure. The disclosed structure of JP 62-173986 employs "auxiliary permanent magnet 4" in order to improve the flatness of the force curve over a larger stroke compared to that produced by the original motor design which employed "operating permanent magnet 3." That is, the original design being improved upon in JP 62-173986 employs "operating permanent magnet 3" as the main permanent magnet of the motor, with the auxiliary magnets 4 being used to enlarge the gap magnetic field, that is, to enlarge the "flat" portion of the response curve, see Fig. 6.

Fundamentally different is the claimed voice coil actuator of the subject application, in which first and second magnets are employed as the main magnets which create the magnetic field for the actuator. It is to be noted that the claimed voice coil actuator includes a "first soft magnetic pole piece," and this soft magnetic pole piece is positioned between the first and second magnets (claims 2 and 5), or has the first and second magnets positioned at different ends (claim 1). As can be seen from Figs. 4 and 6 of the subject application, the

claimed actuator can have resulting force versus stroke curves which are sloped so as to provide an "electromagnetic spring" constants. (Page 5, lines 20-22.)

It is respectfully submitted that the "operating permanent magnet 3" of the JP 62-173968 is not a "soft magnetic pole piece," and because of this the disclosed structure of JP 62-173968 is fundamentally different from the claimed voice coil actuator. In the DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, Fourth Edition, McGraw-Hill, 1989, the term "permanent magnet" is defined as:

A piece of hardened steel or other magnetic material that has been strongly magnetized and retains its magnetism indefinitely.

(See Exhibit A.)

In the same dictionary, the term "soft magnetic material" is defined as:

A magnetic material which is relatively easily magnetized or demagnetized.

(See Exhibit A.)

According to these definitions, the "operating permanent magnet 3" of JP 62-173968 cannot be a "soft magnetic" pole piece because a "permanent magnet" would be understood by one skilled in the art to be strongly magnetized and to retain its magnetism indefinitely, and therefore not a "soft magnetic" pole piece. In contrast, a "soft magnetic material" such as that used in a "soft magnetic pole piece" of the claimed invention, would be understood by one skilled in the art to be relatively easily magnetized or demagnetized, and therefore not a "permanent magnet."

For this reason, JP 62-173968 cannot teach, suggest or make obvious the invention claimed in the subject application.

As a further indication of the fundamental differences between the voice coil motor of JP 62-173968 and the claimed invention, it should be noted that the addition of auxiliary magnets 4 in JP 62-173968 will increase the cost of the


resulting motor, as well as increase the volume of permanent magnet material employed, and increase the overall weight of the motor. In contrast, in the claimed invention, the cost of the voice coil actuator can be reduced because the volume of magnets is reduced, and lower cost soft magnetic material is employed. Further, the overall weight of the actuator can be reduced since the magnets and soft magnetic pole piece can be selected from the beginning to provide the desired force versus stroke characteristic. As can be appreciated from Figs. 4 and 6 and the description in the subject application, the force versus stroke characteristic of the claimed invention can be altered, as required by the particular usage of the actuator, by for example altering the lengths of the first and second permanent magnets and the pole piece. (See, p. 4, lines 20-26, of the subject specification, for example.) Thus as exemplified in Figs. 4 and 6, as a part of the original design without the use of auxiliary magnets, a force versus stroke characteristic can be provided in which the force is greater at one end of the stroke and decreases to its lowest level at the other end of the stroke.

For these reasons, independent claims 1, 2 and 5 are allowable over the cited references, and dependent claims are allowable because they depend from allowable base claims.

For the above reasons, it is respectfully submitted that the Examiner's rejections have been overcome, and the claims are in condition for allowance.

Respectfully submitted,

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Attachments

Amendments to the Drawings:

The attached sheet of drawings includes changes to Fig. 3. This sheet, which includes Fig. 3, replaces the original sheet including Fig. 3. In Fig. 3, the lead line for outer shell 22 has been corrected to point to the two outer most lines in the drawing instead of to the pole piece element 28 as in the previously submitted version of Fig. 3.

Attachment: Replacement Sheet
Annotated Sheet Showing Changes

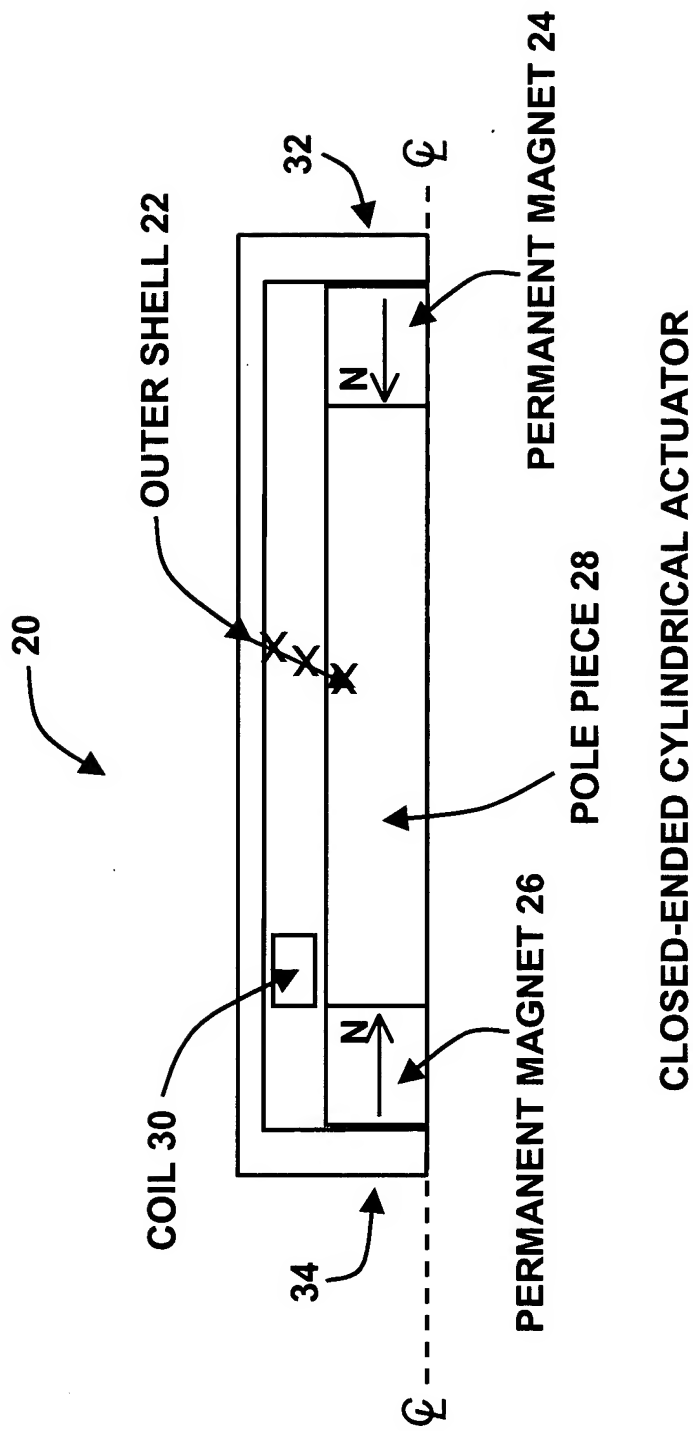


FIG. 3